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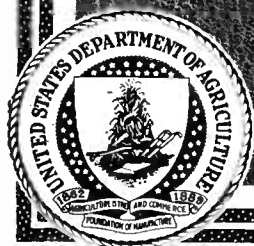
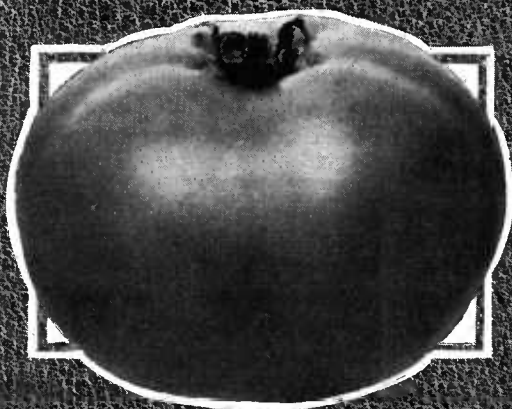
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PREPARATION *of* FRESH TOMATOES FOR MARKET



THE TOMATO, although practically unknown in America in 1818, increased in popularity during the century until the carlot shipments of fresh tomatoes alone in a recent year reached a total of 18,647 cars. In addition to the American-grown fresh tomatoes, there were substantial shipments from Mexico, Cuba, and the Bahama Islands. The average annual carlot shipments for the five-year period ending in 1921 were 17,907 cars. But carlot shipments constitute a relatively small proportion of the total production. It is estimated that twice this amount is produced in home gardens or by market gardeners in the vicinity of consuming centers, and that the production for canning purposes has reached a total of 5 times the volume of the carlot shipments of table stock.

Progressive shippers in all sections of the country are marketing fresh tomatoes properly handled and attractively packed, but there is a serious lack of uniformity in the methods employed even in the same districts. This bulletin is based upon observations in all of the important centers of production. Handling practices that have proved successful in commercial operations are described, together with some that have been prolific sources of loss.

PREPARATION OF FRESH TOMATOES FOR MARKET.

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CONTENTS.

	Page.		Page.
Relation of growing systems to market quality.....	4	Central packing houses.....	15
Commercial varieties.....	5	Grading.....	28
Harvesting.....	6	Inspection.....	29
Packages.....	11	Loading.....	31
Farm packing.....	14	Better methods necessary.....	32

Fresh tomatoes are shipped in carload quantities from more than 25 States, but the bulk of the slicing or table stock moves from 8 States—Florida, California, Mississippi, Texas, Tennessee, Ohio, Illinois, and New Jersey, named in the approximate order of their seasonal movement. Shipments from points in Indiana, Delaware, Utah, New York, and Maryland, although in some instances of large volume, are for the most part used for canning purposes. A very large proportion of the New Jersey crop is also utilized in the canning industry.

Based on the average for the five-year period, 1917–1921, more than 96 per cent of the carlot movement of table stock from the various States is shipped during the months March to October, inclusive. During the remaining part of the year the demand is relatively light and the market is supplied principally from hothouses and by imports from Cuba and the Bahama Islands. Imports from Mexico are at their height during February, March, and April.

The principal producing sections are usually comparatively localized areas which seldom include more than a few loading stations, with the bulk of the movement of table stock centering at one or two points in each section.

In Florida the east coast section, extending north and south from Miami, from Boynton to Florida City, is the most important. There is also a large section on the west coast in the vicinity of Palmetto and a smaller section near Lake Okeechobee. Swedesboro is the largest fresh-tomato shipping point in New Jersey, and in Mississippi, Crystal Springs and Hazlehurst are most important. Most shipments from California originate near Los Angeles. The greater part

of those from Texas comes from Jacksonville or neighboring towns. In Tennessee the towns of Humboldt, Gibson, and Milan hold first place; in Ohio, Marietta; and in southern Illinois, Anna and Cobden.

Carlot shipments of tomatoes from leading shipping States, 1917 to 1921, inclusive.¹

State.	1917	1918	1919	1920	1921	5-year average.
Florida.....	4,496	3,700	4,501	4,511	5,774	4,596
New Jersey.....	3,350	3,468	1,394	2,804	2,121	2,627
California.....	2,524	1,547	2,702	1,958	1,780	2,102
Mississippi.....	1,063	1,379	1,388	1,363	1,961	1,431
Texas.....	1,278	1,123	1,205	1,311	1,972	1,378
New York.....	182	429	1,639	1,945	1,098	1,059
Indiana.....	544	1,150	1,187	1,175	528	917
Delaware.....	1,481	1,225	773	153	189	764
Tennessee.....	1,269	654	385	805	357	694
Ohio.....	628	799	645	330	411	563
Illinois.....	495	393	271	401	161	344
Utah.....	229	633	475	251	100	338
Maryland.....	430	241	326	203	128	266
Kentucky.....	178	58	24	559	367	237
Virginia.....	225	143	156	178	87	158
Pennsylvania.....	15	199	429	49	24	143

Monthly carlot shipments of tomatoes, 1917 to 1921, inclusive.¹

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1917....	6	4	7	821	2,979	2,856	2,933	2,550	3,580	2,497	356	58	18,647
1918....	11	13	486	1,447	1,567	2,963	2,392	3,087	3,853	1,356	207	25	17,407
1919....	39	109	874	1,027	1,928	3,100	1,792	1,377	4,711	2,417	368	42	17,784
1920....	279	533	1,744	567	797	3,326	2,372	2,018	4,990	1,481	212	33	18,352
1921....	33	273	938	1,675	2,812	4,411	1,908	1,071	2,846	937	413	26	17,343
5-yr. av.	74	186	810	1,107	2,017	3,331	2,279	2,021	3,996	1,738	311	37	17,907

¹ Compiled from telegraphic and mail reports made by division superintendents and agents of all the railroads throughout the United States.

RELATION OF GROWING SYSTEMS TO MARKET QUALITY.

There are two general systems of production. In one the plant is allowed to develop naturally, spreading out and falling on the ground as it develops. This is the usual practice throughout the Florida, California, Illinois, and New Jersey sections. In the other, the plant is allowed to develop one, two, or three stems, the number depending upon the grower's estimate of the soil fertility. These stems are loosely tied to stakes as the plant grows and all side branches are kept pinched off. In some sections, particularly in Mississippi and in Texas, the head or top of the stem is also removed after the plant has set fruit on three or four clusters. This practice is thought to induce a more rapid development of the fruit, with a consequent increase in size and firmness of fruit in the upper clusters. In Tennessee and Ohio and near St. Louis, Mo., the staked plants are allowed to develop normally.

Under intensive cultivation the first-formed hand or lowest cluster on the vine often develops one or more rough, ill-shaped tomatoes that

are unsuitable for slicing purposes on account of the large proportion of the fruit wasted in preparation. Likewise, tomatoes grown on the top clusters are often unsatisfactory from the market viewpoint, on account of the smaller size and lack of firmness because of thin outer walls. These top clusters are also often slightly sunburned or show a subnormal, unattractive color when ripe on account of the depletion of the plant foliage and the weakened vitality of the vine during the latter part of the shipping season. Both the rough, ill-shaped, bottom-hand tomatoes and the thin-walled, unattractive top-hand specimens are of inferior quality from the standpoint of market appearance and shipping quality and should be sorted out from the normal-shaped, firm, meaty, and thick-walled fruit before packing for distant shipment.

COMMERCIAL VARIETIES.

Growers in every district should confine their production to a few varieties and choose only those which commonly develop fruit that is smooth, medium in size, and of a similar shade of red when fully ripened. Tomatoes larger than $3\frac{1}{4}$ inches in diameter often are deeply furrowed around the stem end, are ill-shaped, or otherwise objectionable for slicing purposes and seldom command as high a price as those which range from $2\frac{1}{4}$ to $3\frac{1}{4}$ inches in diameter.

In producing sections where several main-crop varieties are grown it is the general practice to disregard variety when packing the stock for market. These sections ordinarily ship their crop as green-wrapped stock and any difference in color is not apparent at this stage. However, after such a lot ripens the mixture of pink and purplish-red varieties in the same package frequently is very noticeable and the unattractive appearance is apt to be reflected in the selling price. A mixture of different-colored varieties is most conspicuous when the tomatoes are marketed without paper wraps. Usually it is preferable to pack each variety separately, but mixing different varieties in the same package is not necessarily objectionable if the tomatoes are approximately the same shade of red.

In southern producing sections, the Livingston Globe or other selections of this variety are popular. In 1920 these constituted approximately 90 per cent of the Florida acreage and were widely grown in Mississippi, Texas, and Tennessee, although the Early Detroit and Acme were important varieties in the latter sections. In California, the Stone is commonly grown for shipping purposes, but is being rapidly displaced by the Globe. North of the Mason and Dixon line the most widely grown varieties for main-crop shipping are Bonny Best, Acme, Stone, and John Baer.

Other varieties are produced to a limited extent in various sections of both the North and the South, but usually are discriminated against by careful buyers, as they are often less desirable in shape and color and are usually soft and of poor shipping quality as compared with the Globe, Acme, Stone, Bonny Best, and other varieties of firm and meaty texture.¹

HARVESTING.

Tomatoes are tender and highly perishable and should be harvested and packed as rapidly as is consistent with careful handling methods. When green and immature, they seem firm and will apparently stand a considerable amount of rough handling, but the damage becomes apparent in the markets after the fruit has ripened. Every effort should be made to lessen the opportunity for injuries which subsequently permit the entrance of decay organisms into the fruit. It is unfortunate that in many sections the harvesting operations are performed by laborers who are either ignorant of or are indifferent to these points. Even well-informed growers and shippers often fail to give proper attention to the improvement of the quality of their product, and in their effort to handle a large acreage they overlook the fact that profits often depend more upon quality than upon quantity.

TIME OF PICKING.

Tomatoes reach a stage of maturity, that will insure proper ripening, several days before any pink or red color develops on the surface. This is especially true of the Globe variety and some others widely grown for table stock. The exact stage of maturity at which they should be gathered therefore depends to a large extent on the distance from the markets. Three definite stages are recognized commercially—mature green, pink, and ripe.

Mature green tomatoes, or "greenwraps" as they are sometimes called, comprise the bulk of the shipments from Florida and Mississippi and a large portion of the movement from Texas, Tennessee, and California. At this stage the tomato is almost fully grown and the interior ripening processes are well under way. The characteristic red color is expected to develop during the period of transit, so that a firm, well-colored specimen can be offered to the consuming trade. Practically speaking, this ideal result is not always secured. A large percentage of the greenwrap stock arrives in the markets without a trace of red color, and even when held for several days in ripening rooms at a temperature of 70° to 75° F. many specimens do not develop normal color. At times this may be caused by low

¹ Beattie, W. R., *Tomatoes as a Truck Crop*. United States Department of Agriculture, *Farmers' Bulletin*, 1311.

temperatures en route, but far more often the fault lies with the pickers, who, in depending upon size as the principal indication of maturity, pick the fruit before it is sufficiently developed.²

In all southern sections where tomatoes are picked at the mature green stage, the vines are gone over at least once a week during the early shipping season and oftener during the warmer weather that usually prevails later. Under such conditions there is frequently a wide variation in the maturity of the fruit at any one picking.

When tomatoes have reached the proper maturity for greenwrap shipments, the content of the seed cavities is slightly moist and of a jelly or glue like consistency and distributed throughout the cavity instead of being dry and firm and attached in a curd-like mass to the interior or core. This content should be sufficiently gelatinous to permit slicing the fruit with a sharp knife without cutting the seeds.

In some sections with certain varieties of tomatoes, such as Livingston Globe and Acme, the presence of light color or whitish area on the blossom end of the tomato is considered a fairly reliable index of picking maturity.

Before issuing instructions to the picking crew, the careful foreman usually selects a number of tomatoes, and after slicing them to determine the relation of the external characteristics to the stage of maturity, bases his instructions to the pickers on the rule which seems to apply best. It is very difficult to lay down any directions which will be followed closely by the pickers, as their usual tendency is to pick all the fruit that has attained a certain size. However, through close supervision and proper cooperation between the foreman in charge of the pickers and the foreman at the packing house, a large proportion of the extremely immature stock which is now received in the markets only to shrivel before attaining normal color might be left on the vines until fully developed.

Pink tomatoes, sometimes referred to as "turning," comprise the bulk of the shipments from southern Illinois, and in some seasons have been shipped extensively from Texas, Tennessee, and other sections. At this stage the tomato should show a slight trace of pink or red color on the blossom end, but in general practice fruit varies from a creamy color on the blossom end to half the surface showing pink or red. The fields should be picked each day, or at least every other day, and pickers have little difficulty in judging the proper stage of maturity. Pink tomatoes seldom are wrapped. The cars are generally iced before loading, but sometimes are placed under refrigeration after the second or third day en route.

² Sando, Charles E., *The Process of Ripening in the Tomato Considered Especially from the Commercial Standpoint*. United States Department of Agriculture, Bulletin 859, 1920.

Ripe tomatoes are shipped locally in the southern sections, but more extensively from those districts which are relatively near the markets, as Ohio, Missouri, and New Jersey. The tomatoes should show most of the surface pink or red, but should be firm and show no indication of softness. Fields should be picked practically every day in order to reduce the chances of packing soft and overripe fruit. Ripe stock is never wrapped and is usually shipped under refrigeration or by express to markets more than one day distant by freight.



FIG. 1.—Three popular types of field crates. Because of its length, the lower crate usually requires two men in handling, and also necessitates wide trucking alleys in the packing house.

PICKING UTENSILS.

Galvanized-iron buckets and one-half bushel round stave baskets equipped with wide bails for the comfort of the pickers are the most satisfactory picking utensils now in use. When containers of larger capacity are used the pickers frequently set them on the ground and toss the fruit from a considerable distance in order to avoid carrying them about from vine to vine. Many growers in southeastern Ohio use the 12-quart Climax basket as a picking utensil as well as a shipping container, and in the Middle Atlantic States the 20-quart

or $\frac{3}{4}$ -bushel truck or brace hamper is often provided with a removable handle and used for picking. The interior of the picking utensil should be inspected carefully and all sharp edges, nail points, and rough surfaces smoothed off. Small skin breaks resulting from rough edges are little noticed when the tomatoes are packed, but may afford an entrance for fungi that will develop rots in transit.

Field crates or lug boxes should be light in weight but durable, and should be equipped with cleats across the top at each end to prevent bruising the fruit in stacking. (See Fig. 1). A slatted folding crate and a solid box with hand holes in the ends, each having an approximate capacity of 1 bushel, are the types in general use. In Florida the orange lug box is often employed. In Tennessee a long and rather shallow type of field crate is used, but it is generally undesirable, as it is too heavy for one man to handle and is so large that unusually wide platform trucks and trucking alleys are required in the packing houses. Field crates should not exceed 1 foot in depth and to conserve space in stacking should be of a shape which permits nesting three together.

In sections where shipments are made in six-basket carriers, this container without the till baskets is sometimes used as a field crate. This practice has been common among members of newly formed cooperative packing associations, where the box shook is assembled by the individual growers. The carrier is very light and flimsy with cracks and with sharp or rough edges that noticeably increase the amount of injury to the fruit. Regardless of whether the carrier lids are attached or not, so large a proportion of the tomatoes has been cut and bruised in hauling from the field and in stacking at the packing house that the associations have usually replaced them with special field crates. In California the lug used for shipping also serves as a field crate.

PICKING.

In large fields the pickers operate in crews under the immediate direction of the grower or his foreman. They are usually paid by the day, although some growers prefer to pay on the basis of the quantity picked. The latter practice is satisfactory when the pickers are closely supervised at all times.

In picking, tomatoes should be grasped in the hand, with the thumb or forefinger pressing against the stem, and separated from the vine by a half turn or twist. Even at the mature green stage they are readily separated, as a layer of hard-walled or corky cells develops at the union of the stem and fruit. This layer forms on the outer rim of the stem and extends inward, and after picking it appears as a brownish ring in the stem eye. The width of this ring is sometimes used in grading operations as an indication of the maturity of green-

wrap lots, specimens being discarded or culled if the brownish ring is narrow or the entire stem-eye area is of a greenish-white cast.

In the field, one row, or two at the very most, should be assigned to each picker, so that the picking baskets will be within convenient reach. Much unnecessary bruising results from the careless emptying of the picking baskets into field crates. It has been pointed out that green tomatoes are easily bruised. In dumping the fruit from the basket to the field crate the latter should be tilted so that the tomatoes are permitted to roll gently down the side of the crate.

Short rows and a generous distribution of field crates at the roadway or end of the row increases the daily output by decreasing the distance which the picker must carry his filled basket. Roadways should



FIG. 2.—The field crates on the sled are kept within convenient reach of the pickers.

extend across the field at intervals of approximately 10 rods, but if this is impracticable, where the vines are staked, the field crates may be placed on a long sled and drawn between the rows. (See Fig. 2.) If the packing shed is adjacent to the field, the filled crates are hauled directly to that point, but if not, they are left at the ends of the rows and placed on a wagon or truck for hauling to the packing house.

Tomatoes should never be hauled in bulk, even though the wagon bed is well padded. The rough handling in loading and unloading, together with the weight of the fruit in a load 20 to 26 inches deep, results in bruising which, although it may escape the scrutiny of the graders, seriously injures the appearance of the tomato after it ripens. This is particularly true where the hauling is done over rough roads in wagons not equipped with bolster springs.

PACKAGES.

There are five important kinds of packages used for the shipment of fresh tomatoes—the six-basket carrier, the four-basket flat, the California or Mexican lug, the New Jersey 20-quart crate, and the 12-quart Climax basket.

Other packages of minor importance in the carlot movement are the Colorado 4½-inch peach box, the Maryland three-basket carrier, the two-hamper carrier, the bushel lug box, the New Jersey 27 and 32-quart crates, and the bushel round-stave basket.

The six-basket carrier shown in Figure 3 is used for practically all the tomato shipments from Florida and for a part of those from Tennessee, Texas, and Mississippi. When properly packed this container has proved thoroughly satisfactory for long-distance shipments.

FIG. 3.—The six-basket carrier is widely used for tomato shipments from the Southern States.

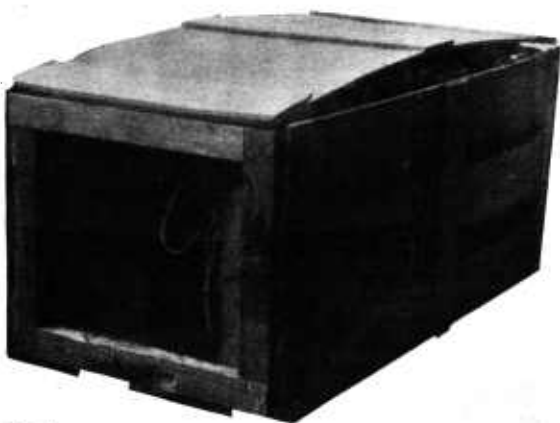


FIG. 4.—Four-basket flats are very popular in the Mississippi Valley sections, especially for farm-packed tomatoes.

The carrier holds six 4-quart till baskets, and these relatively small subcontainers reduce the opportunity for crushing the fruit in transit, either in carlots or in re-shipments from central markets to smaller towns by express or local freight. The six-basket carrier is not a suitable package, however, for farm packing, as the necessary uniform sizing of the fruit in the various layers of the baskets and the system of arrangement in the tills require that the operation be performed by experienced workers under close supervision.

The four-basket flat shown in Figure 4 contains four 3-quart till baskets. It is very popular in the Mississippi, Texas, and Illinois sections and to a somewhat less extent in Tennessee and Missouri. It is a package which is easily refrigerated, and as the till baskets are small, the damage from an occasionally leaky tomato is confined

to a relatively small quantity of stock. The entire contents of the package are more easily inspected than in the case of the six-basket carrier. This point is of particular importance in handling farm-packed stock where the grade and quality are usually irregular and vary with the individual growers.



FIG. 5.—The fruit lug is almost exclusively used for shipments of California tomatoes to northern and eastern markets and for imports from Mexico. One side of the package has been removed to show the arrangement of the fruit.

The four-basket flat has in many instances acquired a bad reputation on account of frail construction and poor nailing. It is not unusual in the markets to find 200 to 350 broken flats in a carload of less than 1,200 packages. This package is not so satisfactory as the six-basket carrier for reshipment to small markets surrounding the centers of distribution, and the cost of handling and trucking is somewhat higher.

The California lug illustrated in Figure 5 is used almost exclusively for shipments from California to northern and eastern markets and for imports of Mexican tomatoes. It is relatively shallow, holding but three layers of fruit, and is substantially constructed, both of

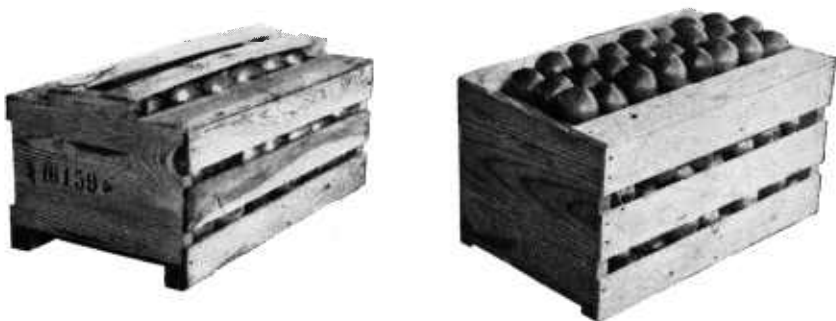


FIG. 6.—The 20-quart and 32-quart New Jersey crates are substantially made from partly planed lumber. The 20-quart size is the one generally used for carlot shipments.

which points are of importance in reducing the amount of damage in transit. The tomatoes are protected from the pressure of the covers by cleats on the ends of the lugs. Tomatoes from the Imperial Valley of California, however, are shipped in a crate holding four tin-top baskets containing 3 quarts or approximately 5 pounds each.

The New Jersey 20-quart crate shown in Figure 6 is widely used in the Swedesboro and southern New Jersey sections for carlot shipments of fresh tomatoes. These crates are used second-hand by market gardeners in the vicinity of New York City. A larger size holding from 27 quarts to 1 bushel is popular in Monmouth County and the northern New Jersey sections adjacent to New York. These crates are usually made of unfinished lumber and present rather an unattractive appearance in the markets. They are not easily refrigerated and the weight of the fruit in a package of this depth frequently causes crushing and leaking of riper tomatoes in the bottom of the crate. They have the advantage of being strongly made and seem to have given satisfaction in the movement of low-priced stock to neighboring markets. Before displaying the product for sale, re-

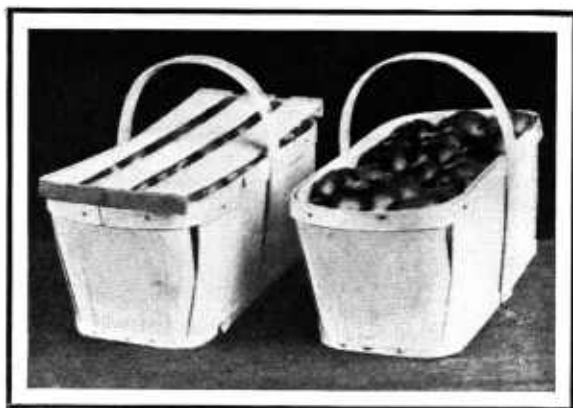


FIG. 7.—The Climax basket of 12 quarts capacity is a neat package of convenient size which readily appeals to the consumer. It is the only package used in southeastern Ohio, and is used to a lesser extent in many other northern sections.

tailers in some markets repack the contents into splint or Climax baskets.

The 12-quart Climax basket illustrated in Figure 7 is favored in Ohio and Indiana shipping sections and is used to some extent in Missouri, Illinois, and New Jersey. The contents are protected by a slatted cover. It is readily prepared by inexperienced packers, and when tomatoes are plentiful it is a convenient and popular size for sales in the original package direct to the consumer. One disadvantage is that a single overripe or leaky tomato is likely to damage much of the contents of the package. As the handles are easily broken, it is not always a satisfactory container under such conditions as prevail in the New York terminal market, where these products are moved about the docks on hand trucks. For the same reason it is not a satisfactory package for reshipment by freight or express to smaller markets.

The 20-quart brace hamper, which also serves as a picking basket, is commonly used for hauling tomatoes from points in Pennsylvania and New Jersey to the Philadelphia market and for rail and boat shipments to canneries. It is customary to return this package to the grower.

FARM PACKING.

In producing sections where the individual holdings are small, it is customary for the grower to grade and pack his tomatoes on the farm, most of the work being done by members of the family. As little or no supervision is given the work, there is a wide variation in the packs; much of the sizing is irregular and the arrangement of the fruit is frequently uneven, loose, and unattractive. A more or less efficient system of inspection is commonly maintained at the

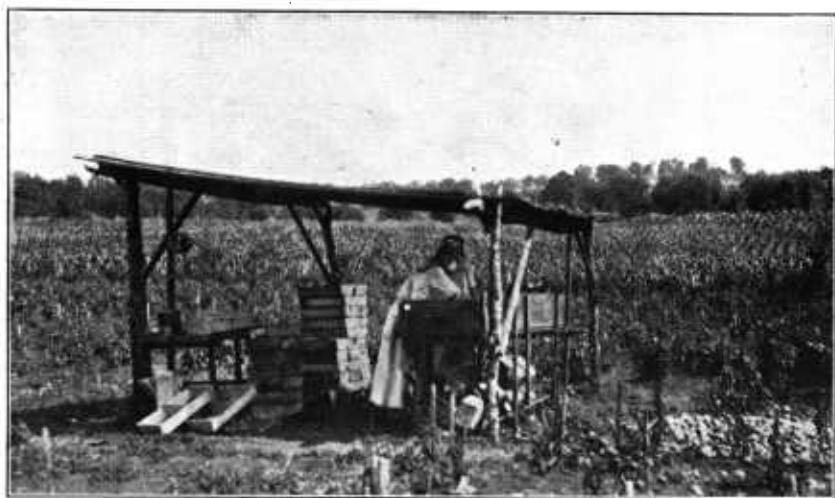


FIG. 8.—Providing shade is the principal point considered in designing the farm packing house for tomatoes.

loading point by the shipper, but the grower's interest and responsibility in the quality of the product ends as each lot is examined and unloaded from the wagon. Unfortunately the shippers usually pay a flat price for the day on all lots which they accept and there is little incentive to the grower to improve his sorting and packing methods.

The grading and packing equipment on small farms is crude. The operations are usually carried on in the shade of a tree or under a temporary roof made of canvas or boards supported at the corners by poles, as shown in Figure 8. The shaded area is usually about 10 feet wide and of sufficient length to accommodate one or more packers and to provide protection for the day's output until it can be hauled to the shipping point. The packing bin is a flat-bottomed, unpadded board bin approximately waist high, 30 inches wide and

8 inches deep and from 6 to 10 feet in length. The packing bench is built along one side of the table.

Since the packing shed commonly is located adjacent to the fields, the pickers carry the baskets to the shed and empty the tomatoes on the table. The packer does the grading and packing and in some cases also nails on the covers. Generally little effort is made to select specimens of uniform size or to pack them according to a definite system, and in many instances the main object apparently is to make the package appear full with the fewest tomatoes that the shipper will accept and to place the more or less defective specimens where they will not be readily seen by the buyer. The principal packages used for farm packing are the four-basket flat, the 12-quart Climax basket, and the New Jersey types of crates.

CENTRAL PACKING HOUSES.

In Florida, Tennessee, and California a large part of the tomato crop is prepared for shipment in central packing houses operated by the shipper, by individual growers who control a large acreage, or in some instances by cooperative associations. Local buyers either purchase the unpacked tomatoes in field lugs or arrange with the grower to act as selling agent and to market the crop on a consignment basis after making a fixed charge per package for sorting and packing. Without regard to the ownership or type of management, these central packing houses have contributed much toward more efficient methods. They have made it possible to place a standardized product on the market, as the operations are on a scale sufficiently large to permit proper division of labor and adequate supervision.

LOCATION.

In communities where most of the crop is grown within a radius of 3 miles from the railroad, the packing house should be located at that point. In such locations it is frequently easier to secure labor locally for sorting and packing, as most of the employees can live at home, whereas the living accommodations on the outlying farms are usually rather limited. If a large part of the fields are at a considerable distance from the railroad, it usually is better to locate the house at a point convenient to the acreage as there is certain to be more or less injury when the unpacked fruit is hauled long distances.

SOME POINTS ON CONSTRUCTION.

With the exception of the relatively light early-season movement from Florida, tomatoes are harvested and packed in warm weather, and one of the principal points that should be considered in constructing a packing house, regardless of its size or capacity, is a

provision for adequate ventilation and ample shade or storage space for both loose and packed fruit. The problem of ventilation is simple in houses (see Fig. 9) where the packing space is not inclosed or where there are large sliding doors and windows. The circulation of air may be increased by providing slatted floors, but as they are not easy to truck over, the ideal arrangement is to provide solid floors in the trucking alleys and slatted floors over the storage space. Covered platforms at the receiving and loading sides of the packing house materially enlarge the protected area for storage purposes.

An abundance of light is needed for the grading operations, because such defects as immaturity, worm injury, and certain types of disease do not show conspicuously on the green or red surface of the tomato



FIG. 9.—Covered platforms materially enlarge the protected area for storage purposes. Windows at side of penthouse structure should be practically continuous in order to light the interior floor space properly.

when the fruit is in shadow. The method of providing illumination depends on the interior arrangement of the house. Where the sorting and packing operations are performed along the side or end of the building, sliding doors or high windows may be placed along the side walls. This arrangement, however, makes it difficult to place the workers so that some will not stand in their own light. If the sorting operations are carried on in the central portion of the house, light may be provided through large skylights or by windows in the penthouse type of roof. If the latter construction is chosen, the penthouse structure should be at least 10 feet in width and the sides furnished with almost continuous sash not less than 2 feet in height. Where houses are provided with lofts for the storage of crate material, shafts or wells are used to admit light and concentrate it directly

over the sorting tables. The interior of these shafts should be painted white to intensify the illumination.

The interior of the packing house should be designed to eliminate, so far as possible, center posts and other obstructions which either interfere with the lighting or with the arrangement of the machinery or other packing-house equipment. A loft is the best place for storing crate material, as it is out of the way of the packing operations and may be made up at that point and distributed to the packers by means of chutes or slides.

In sections where winter shipments of greenwrap stock are made, ripening rooms are sometimes essential. These should be well lined with heavy building paper or some inexpensive insulation that will assist in maintaining a uniform temperature at a minimum expense for heating. The rooms should be relatively small and constructed as separate units in order that temperatures may be held or raised in certain rooms while others are being filled with incoming field crates or emptied by withdrawals to the packing room.

PACKING EQUIPMENT.

The packing bins should be so designed that all of the tomatoes in the bin are within convenient reach. It should not be necessary for the packer to rake or pull the fruit toward him. A very satisfactory design for packing and sorting bins is shown in Figure 10. The packing bins should be about 6 inches in depth at the back, 30 to 36 inches in width, and 36 to 48 inches from back to front, depending upon the pitch of the bin floor toward the packer. The bottom of the bin is usually made of wire netting of about 1-inch mesh, stretched tightly and covered with burlap or canvas. In a few instances specially constructed bins have been installed which have movable bottoms hinged at the upper or sorter's side and at the packer's side supported by coil springs. As the fruit is removed the bottom of the bin is raised so that a supply is always within easy reach of the packer.

If the fruit is sorted directly from the field lugs, they are placed on a bench attached to the grader's side of the packing bin. If a sorting bin like the one illustrated in Figure 10 is used, it should be about 18 inches wide and 6 inches deep. The bottom of the sorting bin is made of canvas or burlap, similar to the bottom of the packing bins.

RECEIVING THE LOOSE FRUIT.

An experienced employee should have charge of receiving the loose fruit from the growers. Where tomatoes are bought at a flat price per field crate, he should make whatever deductions are necessary for

poorly filled crates or improperly picked stock. In California, purchases are usually made on a packed-crate basis. If the packing house is run on a cooperative basis, each lot should be tagged to show the grower's name and the number of packages. As the various lots are graded and packed, a statement of the number of packed crates of each grade and size is added and the tag sent to the office for the permanent record. Perhaps the most important duty of the receiver lies in encouraging the growers to insist on proper care in picking and handling. Where this phase of the work is overlooked,

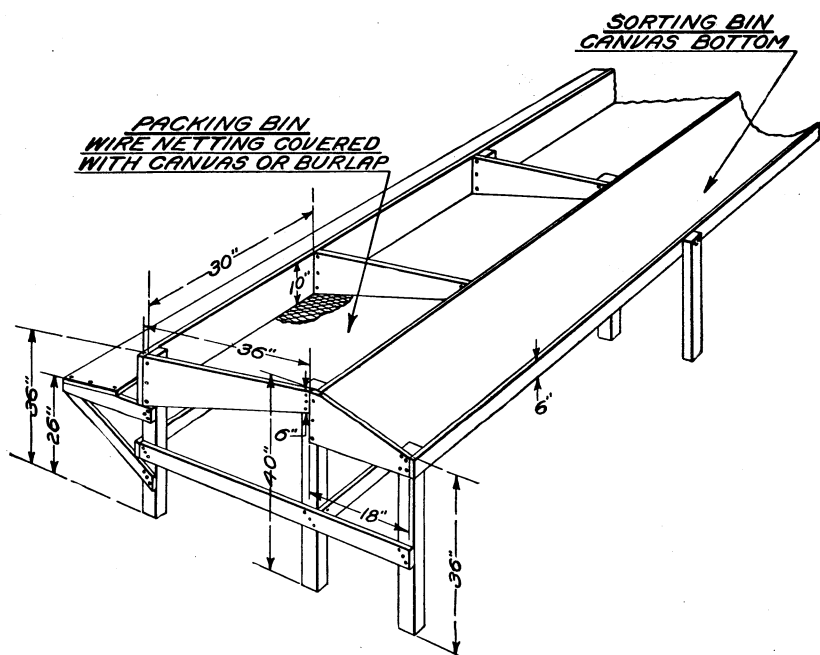


FIG. 10.—Type of sorting and packing bin in general use where grading is done after the field crates are emptied into a sorting bin.

the cost of grading is increased and frequently immature and badly blemished fruit is included, which results in a heavy loss.

Field crates 30 inches or more in length are generally handled on platform trucks by two men, but for crates 2 feet or less in length clamp trucks or ordinary grain hand trucks are used. In some houses the crates are stacked on "dummy bases" or boards raised from the floor by 1-inch cleats at each end to permit the nose of the truck to slip under. These bases are also used for the packed crates to facilitate handling and to prevent the crate labels on four-basket flats from being defaced by the sharp points of the clamp trucks.

GRADING AND SIZING.

Tomatoes are graded for market quality and defects by hand labor and with but few exceptions are sized in the same manner. In a few packing houses various devices and relatively crude machines are used for sizing the fruit, but for the most part the results are unsatisfactory. The sizing is inaccurate chiefly on account of the irregular or flattened shape of the tomato. Observations of many entirely successful sizing machines now used in the apple-packing



FIG. 11.—Worm-eaten tomatoes (above) and those injured by large stake or wind scars (below) should not be packed with the first-grade stock.

industry seem to indicate that with slight changes in design to accomplish a more varied distribution of the fruit to the packing bins, several of these machines could be used for sizing mature green tomatoes and possibly even riper stock.

In most packing houses the sorters are placed along one side of a series of bins (see Fig. 10), and the packers work opposite. Each sorter is assigned two, three, or four bins, the number depending upon the various sizes and grades in the lot he is grading. If mature green stock is being packed, the pink or ripe tomatoes are placed in field crates and carried to special packers or placed in separate compart-

ments of the bin. The culls are thrown into field crates, which are removed when full by the loose-fruit truckers. Each sorter grades and sizes the fruit for one or more packers, the number depending upon the percentage of defective tomatoes which must be culled out.

Packing-house managers frequently insist that the sorters work directly from the field boxes. This is not a good practice because the workmen are hampered by having to reach into the crate and the defects may not be detected. It is much better to empty the field-run fruit into shallow sorting bins like the ones illustrated in Figure

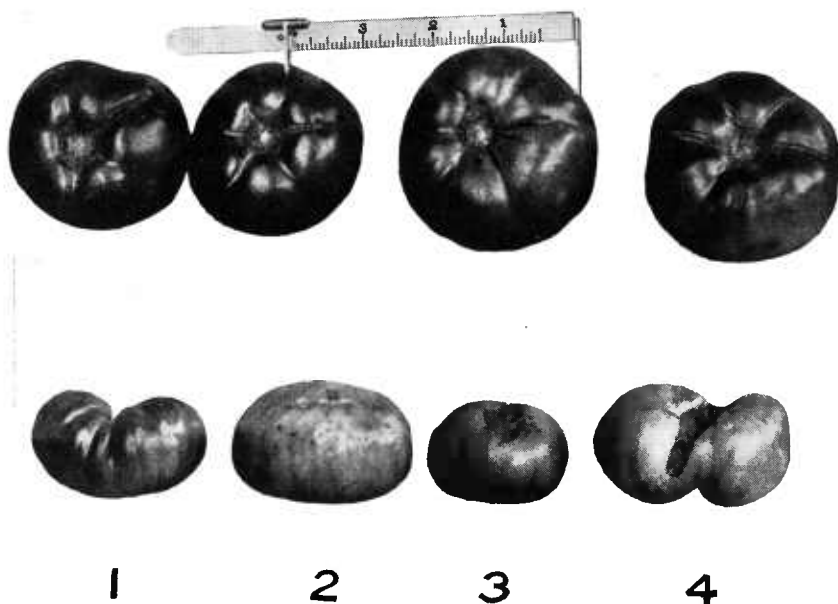


FIG. 12.—Tomatoes showing deep stem end or growth cracks (above) and those that are curly or rough (1), smooth crooks (2), or show large scars and catfaces (3 and 4) should be sorted from the first-grade stock.

10. Although this operation may have a slight tendency to cause bruising, the sorter has greater freedom of action and there is a much better opportunity to see the various blemishes. Some operators have found it more satisfactory to use a canvas conveying belt or roller sorting conveyor. Such an arrangement enables a smaller number of sorters to do the same amount of work, gives greater uniformity in the quality of stock in the packed crates, and provides a better distribution of the fruit to the packers. The sorters should be arranged along the conveyor according to their proficiency, the most experienced members of the crew giving the final inspection.

Types of defective tomatoes are illustrated in Figures 11, 12 and 13.

PACKING.

In most particulars the operation of packing six-basket and four-basket carriers is the same. The packing benches, which should be 26 inches high for six-basket carriers and 31 inches for four-basket flats, are built with a slight slope toward the packer in order that the package will be tilted enough to hold the tomatoes in place

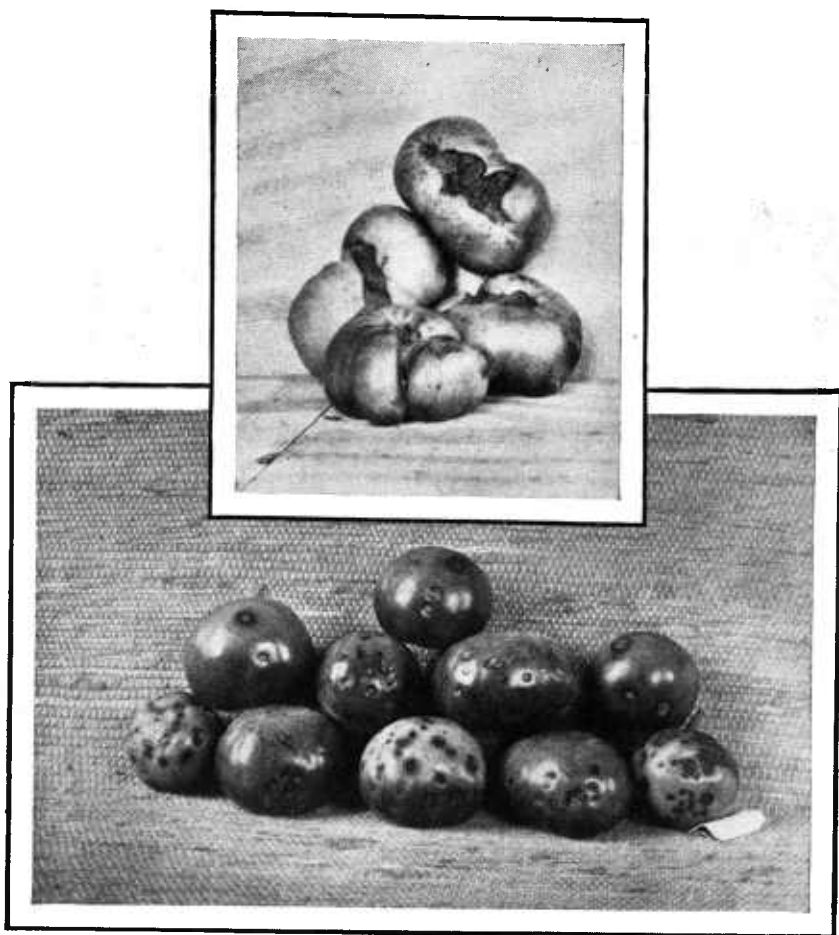


FIG. 13.—Bad "catfaces" and tomatoes affected with Nailhead Spot (*alternaria*) should be excluded even from the second grade.

during the packing operation. A holder for the paper wrappers is placed at one corner of the bin or attached to the package within convenient reach, and where printed wrappers are used for the top layer both printed and plain wrappers are placed in the holder and the bundle of paper is reversed as necessary. A rubber finger cot is often worn on the thumb or forefinger to facilitate the removal of the paper. The dividing trays of the six-basket carrier are placed on

racks commonly located above the packing bins, while the till baskets and an additional supply of paper are stored underneath. Nails, lid covers, and other supplies are placed within reach of the lidding benches.

In packing six-basket carriers and four-basket flats the packer usually faces the bin and reaches over the package for the fruit, but



FIG. 14.—Well-packed six-basket carriers showing the 144 pack (top) and the 120 and 108 packs (below). The upper layer of tomatoes is arranged alike in all three packs, but the lower layer consists of 12, 8, and 6 tomatoes, respectively.

in packing the California fruit lug the packer usually stands with the bin at his side and the lug on a packing stand similar to those used for boxed apples. In either instance a tomato of the proper size is selected from the bin with one hand and at the same time the paper wrapper is removed from the holder with the other. The tomato is then tossed into the paper and is wrapped with one continuous motion,

the loose ends of the wrapper either tightly folded as in apple packing or twisted as in wrapping citrus fruit, after which the tomato is placed in the container with the folded portion of the wrapper underneath, so that it acts as a cushion. Tomatoes are packed in six-basket carriers, according to a definite system, with two layers in each till basket. Several packs are shown in Figures 14, 15, and 16, and the full list is given below.



FIG. 15.—The Gem pack (top) with two tomatoes in each wrapper and the 180 pack (below) with each tomato wrapped individually.

Number, arrangement, and size of tomatoes in the commercial packs of the six-basket carrier.

Numerical count.	Arrangement of bottom layer.	Approximate diameter in inches.	Arrangement of top layer.	Approximate diameter in inches.
72.....	6 flat (3-3).....	3½ to 3½	6 flat (3-3).....	3½ to 3½
84.....	6 flat (3-3).....	3½ to 3½	8 flat (4-4).....	3½ to 3½
96.....	8 flat (4-4).....	3 to 3½	8 flat (4-4).....	3½ to 3½
108.....	6 flat (3-3).....	3½ to 3½	12 edged (4-4-4).....	2½ to 3
120.....	8 flat (4-4).....	3 to 3½	12 edged (4-4-4).....	2½ to 3
144.....	12 edged (4-4-4).....	2½ to 2½	12 edged (4-4-4).....	2½ to 3
162.....	15 edged (5-5-5).....	2½ to 2½	12 edged (4-4-4).....	2½ to 3
180.....	15 edged (5-5-5).....	2½ to 2½	15 edged (5-5-5).....	2½ to 2½
216.....	18 edged (6-6-6).....	1½ to 2½	18 edged (6-6-6).....	2 to 2½
Gem.....	24-27.....	1½ to 2	16-18.....	2 to 2½

In commercial practice, the 84 and 162 packs are seldom used and by some dealers are not regarded as standard packs. In the Gem pack, which is used for very small tomatoes, two are wrapped in each paper, but in other packs each specimen should be wrapped separately. In actual practice tomatoes in the bottom layer of the 216 pack are often wrapped two in a paper.



FIG. 16.—Well-packed six-basket carriers of the 144 and 180 packs ready for lidding. Tomatoes at each end of the crate are even with the headpiece, while stock near the center of the crate shows about 1-inch bulge.

It has already been pointed out that when four-basket flats are packed by inexperienced help little attention is paid to uniformity of size, but when packed under proper supervision, as is the case in central packing houses in Tennessee, the stock is of uniform size and packed according to a definite system, just as in six-basket carriers. Properly packed crates are shown in Figures 17 and 18 and the standard packs are listed below.

Number, arrangement, and size of tomatoes in the standard commercial packs of the four-basket flat.

Numerical count.	Arrangement of bottom layer.	Approximate diameter, in inches.	Arrangement of top layer.	Approximate diameter in inches.
48.....	6 flat (3-3).....	3	6 flat (3-3).....	3½ to 3½
56.....	6 flat (3-3).....	3	8 edged (4-4).....	2½ to 3½
56.....	8 edged (4-4).....	2½	6 flat (3-3).....	3½ to 3½
60.....	9 edged (3-3-3).....	2½	6 flat (3-3).....	3½ to 3½
60.....	6 flat (3-3).....	3	9 edged (3-3-3).....	2½ to 2½
64.....	8 edged (4-4).....	2½	8 edged (4-4).....	2½ to 3
72.....	6 flat (3-3).....	3	12 edged (4-4-4).....	2 to 2½
72.....	8 edged (4-4).....	2½	10 edged (3-4-3).....	2½
80.....	10 edged (3-4-3).....	2½ to 2½	10 edged (3-4-3).....	2½
84.....	10 edged (3-4-3).....	2½ to 2½	11 edged (4-3-4).....	2½ to 2½
88.....	11 edged (4-3-4).....	2 to 2½	11 edged (4-3-4).....	2½ to 2½
96.....	12 edged (4-4-4).....	2 to 2½	12 edged (4-4-4).....	2 to 2½



Fig. 17.—The 60 pack in the four-basket flat. The bottom layer in each basket consists of six tomatoes placed flat with the blossom end up.

In addition to this list of standard packs, a few others are sometimes used, such as the 104 and 120 packs, which include very small sizes, and the 40, 35, 32, 24, and 16 packs for very large sizes, but all of these packs are discounted by buyers, either because of the size of the stock or the irregular nature of the arrangement.

The California lug generally is packed in central houses under the supervision of the shipper. Mature green, pink, and ripe unwrapped tomatoes are all shipped in this package. The fruit is arranged in three layers in such a manner as to provide a tight and slightly bulged pack, as illustrated in Figure 5 on page 12, and arranged in definite rows as shown in Figure 19. The top and bottom layers are placed flat, with the blossom end up, but the central portion of the bottom and middle layers, especially in small sizes, is often placed on edge in order to make the pack higher. The lugs are provided with cleats on the ends which raise the slatted cover practically one-half inch above the fruit at each end. The bulge in the center should touch the cover. Extremely accurate sizing is not attempted, but the

California fresh fruit standardization law requires that the fruit be virtually uniform in size, which is interpreted in the regulations as meaning that the two lower layers of the lug shall not contain more than one additional row of tomatoes each way. In the fruit lug the



FIG. 18.—A well-packed four-basket flat showing the 96 pack in unwrapped fruit. In most instances this is the smallest size packed for shipment. Note that tomatoes are edged in both layers.

size of the stock is described commercially according to the number of rows each way as follows: Small 6-6 or more, medium 5-5, 5-6 packs, and large 4-4 or 4-5 packs, the top layer being taken as the basis of description.

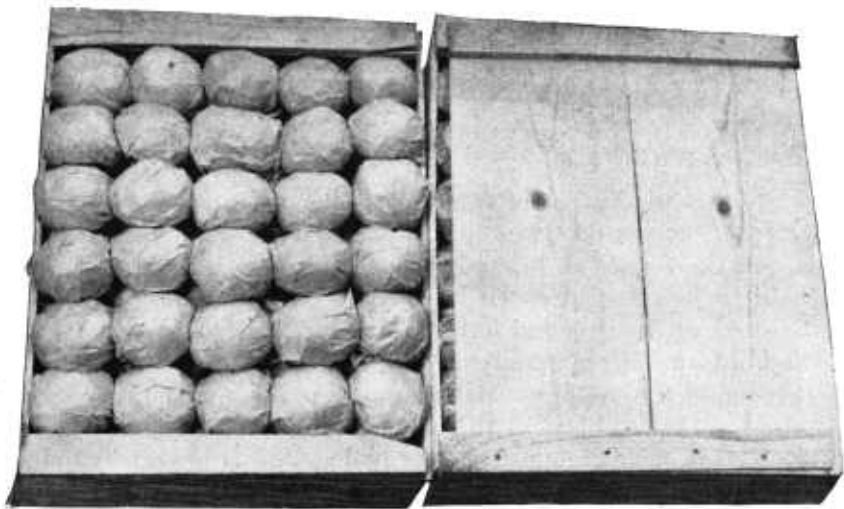


FIG. 19.—Tomatoes packed in fruit lugs are arranged in definite rows and the size expressed accordingly. A 5 by 6 or medium pack is illustrated.

As the packers complete their work they place a numbered pasteboard or ticket on the crate, which is then removed to the lidding bench or to the conveyor leading to that point. These tickets are collected by the ligger and sent to the office for recording the packers' daily output.

MARKING PACKAGES.

The containers are usually marked by the packers with the grade and the numerical count or the style of pack as: No. 1 * * * 216; Fancy * * * 120; or 5-5. In some houses the grower's initials or number are also stamped on the package.

In addition to these marks, shippers are required under the provisions of the net-weight amendment to the United States food and drugs act to stamp tomatoes that are packed in boxes, lugs, or baskets either with the net weight or dry measure. For the present the till baskets used in six-basket and four-basket carriers are not marked with the capacity, but the carriers are marked with the number and capacity of the subcontainers as, "Contents six 4-quart baskets."

If lithographed or printed labels are used, they should be attached neatly, as careless labeling always gives the impression that the pack also is poor. Generally, labels are pasted on before the empty crates are furnished to the packers, but some shippers do the labeling in the car as each stack is stowed.

LIDDING.

Four-basket flats and six-basket carriers ordinarily are lidded under contract on a package basis. The lidding benches, which are from 20 to 24 inches high and of approximately the same width as the length of the package, are substantially constructed of 2-inch lumber. They are placed in the rear of the packers' aisle, parallel to the packing bins. The lids are stored under the bench or within easy reach on a rack overhead. The lidder, in attaching the cover, nails first one end and then the other, the pressing being done by hand. If the fruit is packed with a high bulge it is sometimes necessary to settle the pack with a jar or by a shaking movement before completing the nailing.

The lids of Climax baskets are attached by the packer. In New Jersey, where the 20-quart crate is the principal shipping container, the lids are usually furnished by the shippers and are attached as the crates are loaded into the car.

CLASSIFYING THE LOTS.

After attaching the covers to the carriers, flats, or lugs, the lidder usually separates the packages on the basis of grade and size, and the lots are then removed to the temporary storage space or to the cars. The checking and recording of the marks is done by a member of the office force. This operation usually can be performed more conveniently in the temporary storage space, but is often done as the packages are loaded into the car.

GRADING.

Until the United States Department of Agriculture initiated a series of investigations in 1917, no concerted effort had been made to formulate a standard grade for tomatoes, although for many years some organizations of growers and shippers had marketed their product on a fairly definite grade based on variations in maturity, size, and comparative freedom from defects.

COMMERCIAL PRACTICES.

Three well-defined stages of maturity are recognized: Mature green or "greenwrap," pink, and ripe. In each of these classes stock relatively free from defects is subdivided into several groups or commercial grades based entirely on size. When marketed in six-basket carriers these size grades are termed Fancy, Choice, 216's, and Gems, and similar terms have been applied to stock in the four-basket flats. In some of the other packages the size divisions have been expressed by such terms as Firsts and Seconds, or Large, Medium, and Small. Tomatoes of a noticeably defective nature are variously designated as Crooks, Specials, and Splits. In these classes the sizes are mixed and the numerical count not designated.

The general application of the above terms is similar in the various producing sections and marketing centers, but observations during several seasons indicate a wide variation in the market quality of the stock included in any one grade. During periods of high prices and active demand almost everything is included in the better grade, while a drop in the prices and a slower demand at the shipping point immediately bring an improvement in the quality of the pack.

In actual practice the commercial grades or size designations of the better quality stock are applied in the following manner: In six-basket carriers, Fancy usually includes the 108, 120, and 144 packs, and Choice the 162 and 180 sizes. Although large stock, such as the 72, 84, and 96 packs, is sometimes accepted along with the Fancy, if such sizes comprise any noticeable percentage of a lot they are discounted or sold at practically the same price as the Choice stock. The smaller sizes are termed 216's and Gems, the latter ordinarily being wrapped two in a paper. In four-basket flats, Fancy usually consists of the 48, 56, 60, and 64 sizes; the 36, 40 and 72 packs are also accepted as Fancy when these sizes comprise only a small proportion of the lot. Choice includes the 72, 80, 84, 88, and 96 packs, and in seasons of short crops and active demand the 104 and 120 sizes are sometimes packed as Choice. In the Climax basket and the New Jersey crate, tomatoes larger than $2\frac{1}{4}$ inches in diameter are packed together and marked Fancy or Firsts, while those between $1\frac{3}{4}$ and $2\frac{1}{4}$ inches are marked Choice or Seconds.

FEDERAL GRADES.

After investigations over a period of years it has been found impracticable to formulate a standard grade for tomatoes on the basis of present trade practices. A minimum size which is suitable for the first grade in the earlier season shipments has invariably been considered too low for the later producing sections in the North. However, the standards of market quality are fairly uniform from north to south and from east to west.

The United States Department of Agriculture has prepared tentative specifications dividing the fruit into three grades: U. S. No. 1, U. S. No. 2, and U. S. No. 3. The differences between these three grades relate to market quality.³ A No. 1 tomato must be fairly well shaped and reasonably free from blemishes, but may range in size from small to large, while a No. 2 may be ill shaped and noticeably blemished and likewise be of any size. The consideration of size has not been disregarded, but it is handled as a separate matter; the recommendation of the department provides that in addition to the statement of grade the size shall be given in terms of numerical count, style of pack, or minimum diameter. Under such an arrangement a buyer can order tomatoes packed in 6-basket carriers as U. S. No. 1, sizes 108 to 180, or some other range of size, depending upon his requirements. This system has been given a thorough trial in Florida, New Jersey, and California, with uniform satisfaction to the trade.

INSPECTION.

In central packing houses the foreman acts as inspector. He should frequently examine the tomatoes in the packing bins and note the efficiency of the sorters and graders in the removal of the defective, injured, and low-quality specimens, as well as their accuracy in sizing the fruit. After the stock is packed and before the package is lidded, he should see that the fruit is wrapped neatly and is properly arranged to give a tight, full pack with the desired amount of bulge. In actual practice the foreman's inspection usually is more or less superficial and seldom is sufficiently thorough to impress the graders and packers with the necessity of complying fully with all of his instructions.

At most shipping points farm-packed lots are inspected on the wagon by the shipper's representative, as illustrated in Figure 20, and the low quality and defective stock is rigidly or laxly excluded, depending upon the demand in the distant market and the competition among the local carlot assemblers. In order to systematize the inspection work and put the service on a neutral basis, the shippers at

³ As the tentative tomato grades prepared by the Bureau of Agricultural Economics may be subject to frequent revisions, they are not given here. Copies may be secured upon request to the Bureau of Agricultural Economics, Department of Agriculture, Washington, D. C.

some loading stations carry on the service jointly and prorate the cost for the season on the basis of the number of cars shipped by each. The inspectors usually are local men in whom the growers have confidence, but they operate according to rules promulgated by the shippers.

Under this system an inspector is located at each entrance to the railroad loading yard and the wagons line up for inspection before entering. During the heavy shipping season helpers are supplied to select a fair sample from each load and to relieve the inspector of the work of opening and closing the crates. In some instances a chief inspector is employed whose duty it is to check the work by reinspecting various lots, particularly the larger loads, at the time of unloading, and in case of rejections at either point the lot is either marked down



FIG. 20.—Farm-packed tomatoes are usually inspected on the grower's wagon by the shipper's representative.

to a lower grade or ordered repacked. If the load meets the requirements the grower is given a colored pasteboard ticket indicating the grade and bearing the grower's count of the load. This count is checked at the ear by the loader. After the load passes inspection at the gate the grower disposes of it and makes delivery according to the directions of the buyer, settlement being made on the basis of the inspection tickets and car loader's count.

A combination farm packing house and car inspection is carried on in southeastern Ohio and the results are reflected in the unusually good quality and uniformity of the packs in that section. As practically all of the tomatoes are hauled to the ears during the afternoon, the inspectors are free to spend the mornings with the growers for the purpose of instructing new packers in the work and correcting any unde-

sirable grading or packing practices noted in the car inspection of the previous day's receipts.

More recently several of the State departments of agriculture have established shipping-point inspection services which issue certificates showing the grade and condition of the load, together with information relating to the condition of the car and equipment and other points which are of interest to the parties concerned. These certificates are frequently received as *prima facie* evidence in the courts of the State where the inspection is made. The cost of this service is partially defrayed by the fee that is paid by the applicant.

MARKET INSPECTION.

Under the provisions of the food products inspection law, the United States Department of Agriculture has established an inspection service which is available to shippers of fruits and vegetables on shipments received at certain designated markets and in their vicinity. Representatives of the department are stationed in some 25 important central markets, and more than 150 other markets are also served from these points. This service has been extremely popular and has made it possible for a grower or shipper located in a producing section to receive a report on the condition of his shipment on arrival in the market by a competent and disinterested inspector operating under Federal supervision.

LOADING.

Railway freight tariffs in most sections require a minimum carlot weight of 24,000 pounds for tomatoes, although in some instances the minimum weight is as low as 20,000 pounds. Six-basket carriers, when shipped either ventilated or under refrigeration, are usually loaded 500 to the car. Ventilated cars are loaded 7 rows wide, 17 stacks long, and 4 layers high throughout the load, with a sufficient number of crates added in a fifth layer to bring the total number to 500. In refrigerator cars the arrangement is the same, except that 15 stacks instead of 17 is the more common arrangement and a correspondingly larger number of crates is placed in the fifth layer.

Four-basket flats in ventilated shipments are stowed 6 rows wide, 16 stacks long, and 9 or 10 layers high, the total number of packages varying from 900 to 1,100. The same system is used for refrigerator shipments from points in Tennessee, but refrigerator cars originating in Texas and Mississippi, where a slightly narrower crate is used, are more commonly stowed 7 rows wide and 8 layers high in shipments of pink and ripe stock and 9 to 10 layers high for greenwraps.

California and Mexican lugs are usually shipped in refrigerator cars, but not always. These lugs are usually loaded the entire length

of the car, about 27 stacks long, the number depending upon the length of the car, 5 rows wide, 4 or 5 layers high, making a total of 550 to 650 packages to the car. Mature green stock is shipped a part of the way under ventilation, while pink and ripe stock is sent out under refrigeration.

To prevent side shifting of the load and to decrease the weight of the crates above on the bulge of those below, 8-foot strips about 1 inch thick are placed across the ends of the crates in each layer, but in the case of four-basket flats such strips are seldom nailed in place. Center bracing gates made with uprights in front of each layer of crates, with two or three crossbars at appropriate heights, are spread or wedged apart by cross braces until the entire load is made tight. These cross braces are cut somewhat longer than the distance between the upright gates or frame and are driven into place when nailed, to take up most of the end-to-end slack in the load. This type of bracing is customary for six-basket and four-basket carriers and for California lugs, but in shipments from Mexico the lugs are often stowed solidly throughout length of car.

New Jersey 20-quart crates are usually shipped in refrigerator cars and the crates placed from end to end of the car. The arrangement is 7 rows wide, 18 to 20 stacks long, and 4 layers high, making a total of between 400 and 560 crates.

Climax baskets also are usually shipped in refrigerator cars with a solid load and are stowed 11 rows wide, 23 to 24 stacks long, and 4 to 5 layers high, with a total of 960 to 1,150 packages. The proper method of loading this type of container is shown in Markets Document 14, page 5.

BETTER METHODS NECESSARY.

The nation-wide distribution of truck crops has developed rapidly within recent years, but unfortunately those who have been responsible for preparing them for market have not been able to utilize fully the newly developed markets because of their carelessness or inferior methods. It is believed that a careful study of this bulletin will serve to acquaint the reader in a general way with the best methods of handling tomatoes. If more detailed information is desired in handling local problems, supplementary information may be secured upon application to the United States Department of Agriculture.